CHAPTER VII

CHEMICAL WEED CONTROL

1. Introduction
2. Observations
3. Results and discussion
Weeds are no strangers to man. They have been there ever since starting cultivating of crops about 10,000 B.C. and were undoubtedly recognised as a problem from the beginning (Hay, 1974). Weeds assume importance and pose problem because of their nuisance value. The significant loss to crop yield caused by these unsown and undesirable plant species, reported by various workers justify the world wide efforts to keep them in subjugation. Being an integral component of the crop land, weeds generally influence the general organization and functioning of these man made ecosystems. Weeds may also cause allergies, such as fever and poisoning in living beings. They infest home lawns, gardens, highways, rail roads, industrial areas, irrigation and drainage systems. There are 700 poisonous plant in India. A large number of which are weeds of cultivated fields Chopra (1940) and Changale and Kuspe (1956) noticed that weed annually cause 70 to 80% loss in pulse fields.

A considerable reduction in crop output has also been reported for corn 67%, jawar 10%, rye 20%, oats 25%, barley 32% and wheat 42%. Luthra (1938) has reported that in general weeds may reduce the yield of various crops up to 30% of their total production.

In India from ecological point of view some aspects of few weeds have been dealt by Misra and his co-workers (Misra
and Siva Rao (1948), Mall and Azare (1956) and Mall (1956, 1957). However, research in weed control measures has not been received attention in this country. Studies on weed science are of utmost importance and weed ecologists are required to make sincere efforts to investigate all the weeds on a scientific basis. State of art regarding weed research is being reviewed by Appalanaidu and Singh (1961), Chakraborti (1965), Jaiswal et al., (1979), Templeton et al., (1979) and Vaidya et al., (1977).

As weed infestations began to seriously limit the production of crops, methods were devised to combat them. Thus, came into existence the various manual, mechanical and biological methods and finally the chemical control method of weed control. Some organic and inorganic chemicals are used for eradication of weeds. Bonnet (1886) observed Bordeaux mixture, which is an inorganic mixture acts as a weed killer. Zinc, Iron, Molybdenum, Barium and certain other heavy metals are reported to have herbicidal properties, but lately some organic chemicals are also reported having similar properties, such prominent chemicals are 2,4-D and 2,4,5-T etc.

Application of this modern technology in the form of chemical weed control played a significant role in revolutionizing agriculture in several developed countries of the world. The impact of chemical weed control on
agriculture in the developing countries is only marginal, apparently due to availability of plenty of agricultural labour for manual weed control. However, due to rapid industrialization, increased literacy and mass migration of people to urban areas in these countries, labour availability in villages for agriculture is fast becoming scarce and even if available, the wages are high in relation to agricultural income. Hand weeding is a tedious and unrewarding social activity. Herbicides do replace a sizeable portion of farm labour and this is the main hurdle for their wider usage in the developing countries.

In India herbicides for control of weeds are used only up to a limited extent. As a matter of fact chemical control of weeds in India started with the discovery of 2,4-D in 1942. This discovery was followed by schemes of Indian Council of Agricultural Research to popularised weed control from 1952 onwards. The first trails were made in Tamil Nadu and at Bose Research Institute Calicut, subsequently similar projects were taken up in Madhya Pradesh and Uttar Pradesh.

Topographically Jaloun district where the present studies were conducted, is a plain area and popularly known as Trans Yamuna plains. There are mountains also mainly made up of sand stones, lime stones and shales. Most of the plains are covered by agricultural fields. Herbicides are used in a smaller area of this region and mainly by a selected band of
farmers. Majority of the farmers believe in hand weeding which is a time consuming and tedious job. In view of this it is extremely important to make a record of weeds in terms of their taxonomy, distribution and ecological life cycle along with associated 'karif' and 'tabi' crops on region to region basis.

It is important to test the efficacies of available herbicidal chemicals on weeds and crops, so that suitable recommendation may be made to farmers. With this in mind an attempt is being made here to try presently available chemical herbicides on this dominant weed of northern Uttar Pradesh. In addition to this effect of these weedicides was also studied on three closely associated crops i.e., rice, jwar and wheat.

OBSERVATIONS

On Minora site after the germination and establishment of the weed, weeding was done twice, after a period of 1 month and 2½ months. Data of percentage cover after these two weedings is presented in table 5.1. It indicates that even after two weedings weed still covered a small percentage of ground in fields. Its exact effect on total crop yield is yet to be establishment.
Herbicidal control:

Pre-emergence experiments:

Freshly collected seeds of *M. amarinata* were found to be affected in 500 and 1000 ppm of herbicides and their mixture in the proportion 3:1 of 2,4-D and 2,4,5-T. This was obviously due to the hard seed coat of this weed because after germination the effect of weedicides was observed on the seedling. When slightly scarified seeds were soaked for 24 hours in different concentrations of herbicidal solutions it was observed that there was a significant decrease in the percentage seed germination with an increase in concentration of weedicides.

Table 6.3 presents data on the effect of herbicides on seedling growth of *M. amarinata*. Differential inhibitory effect on the growth of plumule and radicle was observed after giving a treatment of herbicides. 

Parusal of Table 6.3 indicates that, effect of herbicides on plumule was significant, however it was rather insignificant on radicle. It was observed that both the herbicides were harmful to seedling stage of associated crop plants even at lower concentrations.

Effect of 2,4-D and 2,4,5-T on percentage reduction of plumule and radicle was 41.9/71.2 and 50.1/70.2 respectively. A ratio of 3:1 mixture of 2,4-D and 2,4,5-T showed
comparatively less inhibition of plumule and radicle (70.1/80.0). The germination was inhibited up to the tune of 80% with 100 ppm of 2,4,5-T, which was maximum and minimum inhibition of 18 percent germination was observed in a concentration of 2500 ppm of 2,4,5-T.

Post emergence experiments:

After 8.15 and 30 days of germination some selective herbicides were sprayed on the weed. Effect of these were recorded after 8 days. Data are presented in Table 6.6, which indicate that 2,4,5-T was the most effective weed killer. It restarted weed growth at lower concentrations of 100 ppm and 200 ppm. This herbicide also caused some morphological changes in the weed. Effect of 2,4-D on inhibition of plumule and radicle upto 60-90% was significant at a concentration of 1000 ppm. In case of 2,4,5-T a similar trend was observed at 1000 ppm and the plumule and radicle were reduced upto 50 and 70%, respectively. (Table 6.5)

DISCUSSION

Weed control problem presented a major challenge to modern agriculture. Although hand weeding is effective and used on large scale but it is laborious, time consuming and expensive. However, within the past quarter century it has been possible to eliminate these weeds chemically and are under control to some extent. Chemical weed control alleviates the tremendous burden of hand weeding and also increases the income of farmers. Many chemicals are found to have different
properties for controlling weeds in the fields. These chemicals effectively check the weed growth and eradicate the weeds (Ashraf et al., 1977; Verma, 1981; Pandya, 1983).

Successful use of various chemicals have been suggested by a number of workers (Asana et al., 1955; Singh et al., 1960; Khosla, 1968; Shopov, 1972; Singh and Choudhary 1970; Singh, 1973; Naik et al., 1977; Reddi et al., 1977; Seshadrinath et al., 1980; Ventetaramjean et al., 1984; Petvadzhieva et al., 1985; Rao et al., 1985 and Wiese et al., 1986).

The knowledge about the metabolic pathway and degradation of herbicide in plants is very scanty and needs an extensive research. It was reported that different herbicides have different mode of action (Smith et al., 1971; Ashton and Crafts, 1973). The resistance and susceptibility of a particular plant is determined by its potentiality to convert herbicides enzymatically and this may be possible reason of selective action of herbicides (Main, 1955).

The use of 2,4-D as selective herbicide depends upon the conversion to an active growth substance within the tissue of susceptible plants. Therefore, this compound can only be used against susceptible plants with a limited number of crops and all kinds of weeds are not destroyed. Higher concentration of 2,4-D and 2,4,5-T were found to be deleterious for all the weeds tested. Higher doses of both the herbicides were
previously reported to be harmful (Klingman and Ashton, 1975). Matlib and Kirwood (1976) found that 2,4-D and 2,4,5-T inhibit phosphate uptake in bean roots by uncoupling or inhibiting oxidative phosphorylation. After spraying treatment with 2,4-D and 2,4,5-T some morphological changes observed in weeds as reported earlier by Craft and Yamaguchi, 1964; Khosla, 1967; Craft and Crisp, 1971; Bakal, 1972; Unikrishnan and Hariharan, 1975; Rao and Putnam, 1980) etc.

Unikrishnan and Hariharan (1975) reported epinastic curvature in various plants in response to 2,4-D spray application. Kolhe (1979) reported same abnormalities in Tephrosia candica and Ulosia argentea with 2,4-D spray treatment.

Rao (1981) reported that occurrence of rain soon after application of foliage applied herbicides (2,4-D) reduces the effectiveness of the chemical. This is due to washing off the spray deposits off the foliage which is highly soluble in water, penetrate leaf surfaces very slowly and can be washed off by rain occurring within 4 to 6 hours of application.

Table 6.4 indicates the post emergence field conditions were also affected by 2,4-D and 2,4,5-T. These are most successful weed killer. They reported seedling growth at early stages at lower concentrations of 200 and 100 ppm. It is also indicated (Table 6.6) that plants are very susceptible
to herbicides at their early stages of growth.

The % reduction of *M. emarginata* seeds and seedling growth may be due to change in its metabolic pathways by given chemical treatments, because 2,4,5-T was reported to increase the R.N.A. and D.N.A. content of root tissue and increase protein synthesis in excised hypocotyl and root in cucumber (Edmondson, 1969). It is an effective herbicide in controlling weeds of upland rice fields (Ghosh *et al*., 1977).

In the present study 2,4-D was found to be less effective in comparison to 2,4,5-T. Seeds of *M. emarginata* were capable to germinate even at 1000 ppm concentrations. These (2,4-D and 2,4,5-T) are important herbicides used to control most of the annual grasses and broad leaved weeds associated with rice, jwar and wheat crops.